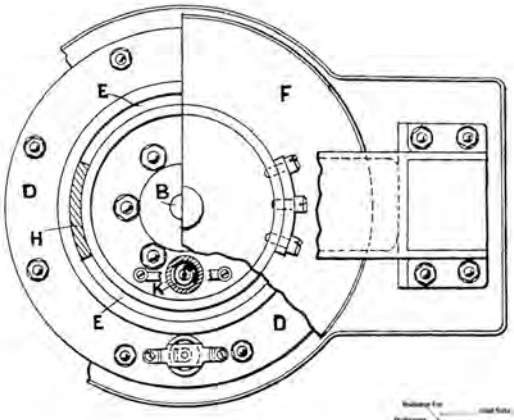
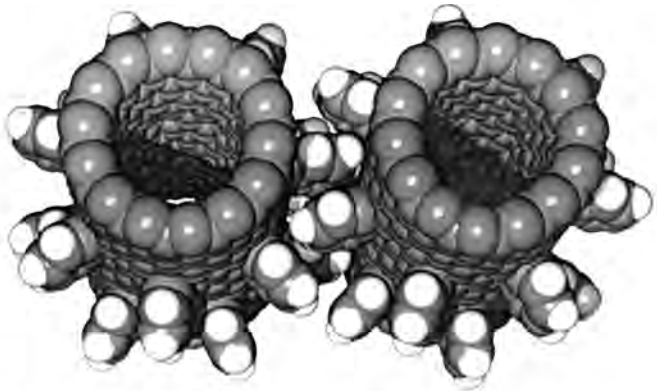
National Aeronautics and Space Administration

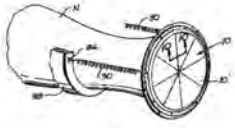
Patents

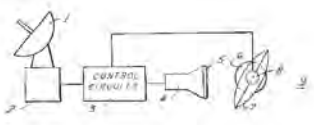
Invention Disclosure Information for NASA Inventors

The United States of America









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Content

Why Your Inventions are Important to NASA

The United States Government in general and NASA in particular, employ many of the finest scientific and technical personnel available in the world. Many scientists and engineers, however, are unaware that patent protection for inventions is very important to the Government.

This publication is intended to open the door, for the NASA scientists, engineers, and other NASA inventors, to the seemingly complex world of patents; to guide the inventor along the path to patent protection; and to remove the mystique that sometimes surrounds the subject of patents.

Patents are of considerable value to Government employee inventors in several ways. First, there is a monetary incentive award given to the inventor upon the filing of a patent application in the U.S. Patent and Trademark Office (PTO). Second, supplemental awards may also be given to NASA inventors for significant inventions. Third, NASA employees may share in liscence royalties if NASA liscenses the invention. Fourth, depending upon the circumstances under which the invention was made, commercial rights may be retained by the inventor. The value of such commercial rights will, of course, depend upon the adaptability of the invention to use in the civilian economy. Fifth, having a patent issued enhances the inventor's professional prestige, as the number of patents issued to an inventor is commonly viewed as an indication of the inventor's scientific creativity and could enhance future promotions or job opportunities.

The value to the Government of patents on Government employee inventions is twofold. First, they protect the Government from potential infringement claims and suits for money damages. In order to carry out the varied missions of NASA, it is necessary to buy and use products developed in many fields of technological development. Therefore, NASA, as well as its contractors, is involved in enormous research and development efforts to provide the items necessary to improve the effectiveness of NASA. Patents serve to protect NASA against payment of royalties for using technology which was first developed by a NASA inventor and provide protection against multimillion dollar infringement claims and suits. Second, NASA has always been a leader in the Government in the transfer of its technology to the private sector. Obtaining patents is a key component of NASA's technology transfer activities because patents allow full public disclosure while providing exclusivity in order to lay a foundation

for business investment and development. Patents facilitate rapid commercialization of an invention through licensing agreements with commercial firms.

Protecting NASA Inventions

As discussed above, new ideas and inventions are very important, both commercially and for the advancement of our Country in general. What is the best method of protecting these inventions of NASA employees? Ordinarily, when an inventor makes an invention, there are three courses of action which may be taken to protect the invention:

1. Keep the invention secret in order to protect it (i.e., the invention becomes a "trade secret"), or
2. Publicize the invention by writing or other suitable means, or
3. File a patent application.

Trade Secrecy Protection

If the inventor elects to keep the invention secret, some other person may come along at a later date and, having independently made the same invention, may patent it or make it public, and receive full credit. The inventor who keeps his invention secret can rarely establish that he thought of the idea first. Therefore, when thousands of researchers are seeking new developments in many fields of technology, secrecy alone may afford poor protection, especially for Government inventions. Because NASA is subject to the Freedom of Information Act (FOIA), keeping our inventions as a trade secret may be extremely difficult. In addition, NASA's charter under the Space Act (42 U.S.C § 2473, Pub. L. No. 85-568, As Amended) is to disseminate technical information to the public. Clearly, trade secrecy protection for NASA inventions would be contrary to this purpose. Trade secrecy protection is more commonly used in industry, such as the formulas for Coke, or Kentucky Fried Chicken, which are famous examples of trade secrets.

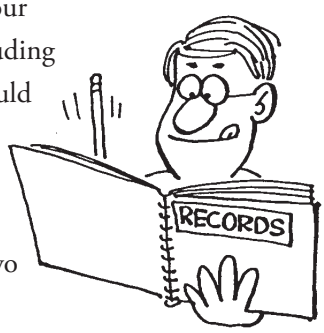
Protection by Publication

Some inventors elect to publish their inventions, and one might think that sufficient. However, another inventor may independently make the same invention and file a patent application within a year of the publication, "swear back of the publication date," and obtain a patent. A person can "swear back of the publication date" by filing a declaration of prior invention with the PTO. After the patent is granted, the patent holder will be able to keep the public, including the author of the publication, from practicing the invention for the life of the patent. Many NASA scientists and engineers are eager to quickly publish the results of their research efforts to widely disseminate the results and to gain recognition from their peers in the scientific community. While this is an admirable motive, however, NASA

scientists and engineers should always keep in mind the potential value of NASA's "intellectual property" which they may be giving away for free!

Good Recordkeeping is Important!

It is often very important to be able to establish, from only your WRITTEN RECORDS, the date on which your invention was conceived. As soon as possible, you should put your ideas in writing, describing in as much detail as possible your concept or discovery (including ideas and sketches or drawings), and explain how the invention works. This writing should then be maintained in a permanently bound notebook with numbered pages, and shown in confidence, preferably to a disinterested friend or fellow worker, and described so that he or she understands your idea. Your friend should then be asked to witness that he or she "read and understood" the document by signing and dating it. Two witnesses are better than one. Standard laboratory notebooks, available from the Patent Counsel, when properly completed and witnessed, are the best evidence of the date of invention. Even if you keep your records on a personal computer, make a printout of the description and then permanently paste it into the lab notebook. Never remove pages from a laboratory notebook.



Copyright Protection

A copyright protects the works of an author against being copied. The scope of copyright protection includes all kinds of literary, pictorial, graphic, sculptural, audiovisual, visual, dramatic, or musical works. The copyright prevents others from copying the creation of the author and goes only to the form of expression rather than to the subject matter of the writing. For example, a description of a machine could be copyrighted as a work of authorship, but the copyright would not prevent others from writing a description of their own, or from making and using the machine.

There are some exceptions to the copyright owner's exclusive right to permit copying or distribution of a copyrighted work. These exceptions include "fair use" copies, e.g. copies made for teaching, scholarship, or research and library archive copies. Unless an exception applies, the user must obtain permission to use the copyrighted work, which may involve the purchase of a license. Use for governmental purposes without permission could result in liability of the Government under 28 U.S.C. § 1498.

By law, no copyright can be obtained on works authored solely by a Government employee as part of his or her official duties, although the Government can own a copyright on works of non-government entities by assignment. Any questions relating to the use of copyrighted works should be directed to the Center's Patent Counsel.

Trademark Protection

A trademark is a distinctive word, emblem, symbol or device providing goods in commerce with an identification and/or distinctive appearance over similar goods of others. Goodwill

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built through effective advertising and longstanding use of a trademark might otherwise be lost through imitation and piracy. Trademark rights prevent others from using the same or a confusingly similar name on the same or similar goods, but do not prevent others from making the same or similar goods without using the trademark.

The U.S. Government, though not in commerce in the traditional sense, nevertheless owns numerous trademarks, including the Army slogan "Be all you can be" and the NASA-owned trademark "NASTRAN."

Government Ownership of Inventions

The U.S. Government owns many thousands of patents. Some of these patents are the result of inventions made by employees of the Federal Government, while others result from inventions made under Government contracts. Government ownership of inventions can also arise from Space Act Agreements, research done by NASA employees on leave attending universities, collaborations between NASA employees and private parties, etc.

In general, inventions in which NASA has an interest arise in one of the following three ways: (1) Employee disclosed inventions, (2) Contractor disclosed inventions, (3) Joint inventions between NASA employees and non-NASA employees.

Employee Disclosed Inventions

The respective rights of the Government and federal employees in employee inventions are governed by Executive Order 10096, as amended by Executive Order 10930. These two executive orders set forth a policy contained in 37 CFR § 501 which, under most circumstances where there is any nexus between the employee's Federal job and the invention, results in the Government having the title to the invention. The regulation [37 CFR § 501.6(a)(1)] states:

The Government shall obtain... the entire domestic right, title, and interest in and to any invention made by any Government employee:

i. During working hours, or

ii. With a contribution by the Government of facilities, equipment, materials, funds, or information, or of time or services of other Government employees on official duty, or

iii. Which bears a direct relation to or is made in consequence of the official duties of the inventor.

The regulation [37 CFR § 501.6(2)] further states that the Government must leave title with the federal employee in the following two situations:

1. The contribution of the Government . . . is insufficient equitably to justify a requirement of assignment of the entire right, title and interest, or

2. The Government has insufficient interest in an invention to obtain the entire right, title, and interest.

The retention of title by the inventor is "subject however, to the reservation to the Government of a nonexclusive, irrevocable, royalty-free license in the invention with power to grant licenses for all governmental purposes."

Rights Determinations

When an employee of NASA submits an invention disclosure to the Patent Counsel, the employee will be requested to complete NASA Form 434 entitled "Patent Rights Questionnaire" (see Appendix A-1). If the inventor recognizes that the Government is entitled to all rights, as explained above, only the portion entitled "Agreement to Assign" need be completed. If the inventor believes that the Government is entitled to less than all rights in the invention, the entire form should be completed.

Except when the inventor assigns all rights to the Government, the Patent Counsel will prepare a "Determination of Rights" in the invention, which outlines the Government's reasoning for either granting or denying rights to the employee, and which will be forwarded to NASA Headquarters for approval. Based upon this document, the rights of the parties in the invention will be set forth.

NASA employees who do not agree with the determination of rights in an invention may obtain review of that determination by the Secretary of Commerce under the procedures set forth in 37 CFR § 501.8. The aggrieved employee has 30 days from receipt of the NASA Headquarters approved determination to file the appeal.

Contractor Disclosed inventions

The Space Act, Section 305(a) [42 USC § 2457(a)] provides that whenever any invention is made in the performance of any work under a NASA contract, the invention is the exclusive property of the United States if the Administrator determines that the contractor employee was acting within the scope of his employment duties under the contract. Each NASA contract is required to contain provisions under which the contractor:

"shall furnish promptly to the Administrator a written report containing full and complete technical information concerning any invention, discovery, improvement, or innovation which may be made in the performance of such work."

This statutory requirement is implemented by the inclusion of either the NASA FAR Supplement (NFS) clause 1852.227-70 [New Technology] or by the Federal Acquisition Regulation (FAR) clause 52.227-11 as modified by NFS 1852.227-11 [Patent Rights--Retention by the Contractor (Short Form)] into NASA contracts.

Large Business

For "large entities" [i.e., big business], NFS clause 1852.227-70 creates a presumption that all "reportable items" [i.e., inventions] were made by the contractor per the Space Act unless the contractor can prove otherwise. Thus, the Government "owns" the invention and the contractor is granted a revocable royalty-free license. The contractor may request that NASA waive its rights to the invention [NFS1852.227-70(3)]. The request is reviewed by the NASA Inventions and Contributions Board, with final approval by the Administrator. If the waiver is granted, the Government reserves a nonexclusive, irrevocable royalty-free license and other rights as outlined in 14 CFR § 1245.107.

Small Business

For "small entities" [i.e., small business, universities, or non-profit organizations], FAR clause 52.227-11 results in almost the exact reversal of the situation above. The contractor has the right to elect title to the invention, and the Government has an irrevocable, nonexclusive royalty-free license in the invention. NASA allows small business up to two years to decide whether they wish to retain title. If they choose not to, then title in the invention reverts to NASA, or may go to the inventor if NASA does not wish to obtain a patent or otherwise commercialize the invention.

Joint Inventors (NASA & Non-NASA Employees)

What about when a NASA and a non-NASA employee jointly make an invention? The answer depends upon the status of the non-NASA employee. If the non-NASA employee is working for NASA under a contract or cooperative agreement, then the contract provisions discussed above apply. If the non-NASA employee is not working under a contract or grant, then the non-NASA employee has an undivided interest in the invention. If NASA is entitled to an assignment by the NASA employee, then the invention is jointly owned by NASA and the non-NASA employee. If NASA is not entitled to an assignment by the NASA employee, then the invention is jointly owned by the NASA employee and the non-NASA employee. The exact circumstances under which NASA would choose to file a patent application on joint inventions vary widely. If this situation arises, the NASA inventor should contact the Patent Counsel for advice.

Patent Protection of Inventions

A U.S. patent is a grant by the U.S. Government to an inventor for a limited period of time to EXCLUDE others from making, using, or selling the invention in the United States. Patent grants are authorized by Article 1, Section 8 of the Constitution:

"Congress shall have the power to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writing and

discoveries."

The patent DOES NOT, however, give the inventor the right to make, use or sell HIS or HER invention. That right may be subject to the superior right of a dominant patent issued earlier upon which the inventor has improved.

Historical Background

Prior to 1790 (i.e., prior to the Constitution of the U.S.), American colonies granted patents by special acts of legislature; therefore, it was necessary for an inventor to make a special appeal to the governing body of the colony or state to protect an invention. The first such patent on this continent was granted by the Massachusetts General Court to Samuel Winslow in 1641 for a novel method of making salt.

In 1790, the fee for a patent was approximately$4. Thomas Jefferson was the first Commissioner of Patents, and he personally examined all applications. Samuel Hopkins received the first U.S. Patent for an improved method of making potash. A total of 55 patents were issued between 1790 and 1793.

On March 14, 1794, Eli Whitney received a patent for his famous "cotton gin," and on May 5, 1809, Mary Kies was the first woman to receive a patent for an invention relating to "weaving straw with silk or thread." On June 21, 1834, Cyrus H. McCormick received a patent for his reaper, and on Feb 25, 1836, Samual Colt received one for his revolving barrel gun. In 1842, Ornamental Designs were made patentable. In 1849, Abraham Lincoln received a patent for "A device for buoying vessels over shoals." In 1870, the Patent Office was given jurisdiction over trademarks. Approximately 105,000 patents had been issued to this date. In 1873, Louis Pasteur received a patent for "Improvements in the process of making beer." Thomas Edison received a patent on the phonograph in 1878 and on the "electric light bulb" in 1880. In 1893, the zipper was patented, and in 1898, the wireless telegraph (radio) was patented.

Patent number 1,000,000 was issued in 1911. In 1930, plants were made patentable, and on Aug 18, 1931, plant patent number 1 was issued to Henry Bosenberg for "a climbing rose." In 1935, patent number 2,000,000 issued. In 1936, design patent number 100,000 issued. In 1961, patent number 3,000,000 issued. In 1975, patent number 4,000,000 issued, and in 1991, patent number 5,000,000 issued.

What Inventions and Discoveries Can be Patented?

There are three basic requirements for patentability; the invention or discovery must be (1) NEW, (2) USEFUL, and (3) NONOBVIOUS. In addition, the invention must fall into one of the six "statutory" classes described below. "New" means that the invention or discovery was first made by the inventor seeking the patent (i.e., it hasn't been done before). "Useful" means that the invention or discovery must have at least one lawful purpose and is workable.

"Nonobvious" means that the invention or discovery is not reasonably "suggested" by an invention or discovery which has been disclosed to the public through publication or use. In addition to these basic requirements, the person making the application for a patent must be the actual inventor or discoverer of the item. Hence, NASA as an entity can not be an "inventor" and apply for a patent. Instead, the NASA employee (or contractor employee) who invented the new, useful, and unonobvious invention must be the applicant, and NASA can obtain an assignment of the invention from the inventor.

Statutory Classes

There are six "statutory" classes of inventions under U.S. patent law: (1) Processes, (2) Machines, (3) Articles of Manufacture, (4) Compositions of Matter, (5) Designs, and (6) Plants. The invention must fall into one of these classes to be patentable. New and useful improvements to classes (1) - (4) are also patentable.

Processes

The word "process" includes not only those processes or methods which are purely chemical, but also those which involve successive physical or mechanical steps to obtain useful results. An example of a process, or method, patent is shown in Appendix B-1.

Machines

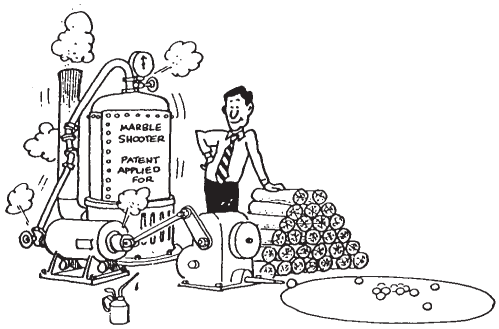
The second class is termed "a machine." This class includes electrical circuitry, and encompasses generally any operating system which functions according to an inherent natural law to produce a useful result. An example of an electrical circuit "machine" is shown in Appendix B-2. An example of a mechanical "machine" is shown in Appendix B-3.

Articles of Manufacture

The third class is an "article of manufacture" which comprehends generally a dormant device without a particular mode of operation (e.g., wrench, hammer, etc.). Animal patents also fall into this category. An example of an article of manufacture is shown in Appendix B-4.

Compositions of Matter

The fourth class is the "composition of matter," which includes chemical compounds or mixtures (e.g., explosives, fuel compositions, plastics, synthetic fibers, alloys, food formulations). An example of a composition of matter is shown in Appendix B-5.



The above four statutory classes of inventions constitute what are called "utility inventions." Utility patents comprise by far the majority of patents issued in the United States.

Designs

Design patents cover only the ornamental appearance of an article of manufacture. They have nothing to do with its operation or function,

but only its external appearance. Typical design patents include printed designs in dress materials, plastic cabinets or furniture, new designs for playing cards, and tire treads. An example of a design patent is shown in Appendix B-6.

Plants

The plant patent is granted for new, asexually reproduced plants. Most of the patented plants are new varieties of fruit trees, bushes, vines, and ornamental flowering plants. An example of a plant patent is shown in Appendix
B-7.

New and Useful Improvements

Any new and useful improvement of a method, machine, article of manufacture, or composition of matter can also be patented. An example of an "improvement" patent is shown in Appendix B-8.

Examples of New "ideas" that Can't Be Patented

Not every new idea or discovery is patentable. Certain "discoveries" are not really new, but merely previously unknown or unappreciated subject matter. They include principles, laws of nature, or natural forces (e.g., Einstein couldn't patent $E=mc^2$), and naturally occurring articles (e.g., the discovery of radium by Madam Curie).

Another group of subject matter that has been excluded by judicial construction includes printed matter, mental processes, mere chemical formulas, systems of bookkeeping, fundamental truths, original causes, motives, methods of calculation and mental steps.

Disclosing Your Inventions to NASA

Authority

Employees under the jurisdiction of NASA are responsible for:

(1) Assuring that their inventions are disclosed to the Center's Patent Counsel;

(2) Informing the Patent Counsel of any proposed publications, public use, or oral public disclosures which may create a bar for patent protection, and taking all reasonable steps to prevent such bars;

(3) Agreeing, upon request, to assign the invention to the Government; or, if it is believed that NASA is not entitled to an assignment, furnishing information regarding the circumstances under which the invention was made so that a determination of rights can be made;

(4) Executing all necessary documents for NASA to file and prosecute patent applications (U.S. and foreign), and obtain and maintain patents for assigned inventions; and

(5) Assisting in the prosecution of such patent application(s); including, if needed, making available records relating to the conception or reduction to practice of the invention.

When and How to Disclose

The NASA inventor should disclose his invention to the Patent Counsel as soon as possible after "conception" of the invention. The "conception" of an invention occurs when the inventor has formulated the complete invention in sufficient detail as to enable a person of ordinary skill in the art to make and use the invention without resort to undue further inventiveness or experimentation. A broad idea is not the conception of an invention where the one having the idea lacks sufficient information or understanding to adequately describe or to construct the device. "Conception," however, does not also mean "construction." The inventor does not have to build and test the invention in order to "reduce it to practice," but the inventor must be able to adequately describe the invention so that the filing of the patent application results in a "constructive" reduction to practice. The PTO rarely requires that a model of the invention be built; in fact, the only time in recent history when a model was required was when the inventor claimed that he had invented a "perpetual motion" machine.

Inventions are disclosed to the Center's Patent Counsel as a "Disclosure of Invention and New Technology (Including Software)" report. This disclosure is preferably done electronically via a website know as eNTRe. This website is designed specifically to help NASA employees and parties under NASA funding agreements (i.e., contracts, grants, cooperative agreements, and subcontractors thereunder) report new technology information directly, via a secure Internet connection, to NASA (http://invention.nasa.gov).

Correct Inventorship is Important

A person is not entitled to a patent if the inventor did not invent the subject matter sought to be patented. A U.S. patent must be applied for in the name of the actual inventor or inventors, and a U.S. patent which is applied for by one who is not the true inventor is unauthorized by law and void. A person to whom the true inventor communicates the idea of the invention is not considered the inventor, but the fact that the applicant makes inquiries or received advice from others in the course of research does not preclude a claim of inventorship. Also, a person who suggests to another that a certain thing be done but who does not suggest the method or apparatus embodied in the patent application is not the inventor. Typically, for a suggestion to constitute part of an invention, the suggestion must have furnished enough information to enable an ordinary mechanic to put the invention into operation without the exercise of any ingenuity or special skill.

When an invention is made by two or more persons jointly, all inventors must be listed on the patent application. Barring specific extenuating circumstances (e.g., an inventor's death or refusal to participate), none of the joint inventors alone, nor less than the entire number,

can apply for a patent on an invention made by them jointly. Inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent. A co-inventor whose suggestion transforms a marginally operable invention into a successful one is properly named a joint inventor. However, typically a person is not a co-inventor if he merely offers a suggestion to the inventor or merely assists the inventor. For example, a test engineer would normally not be a co-inventor.

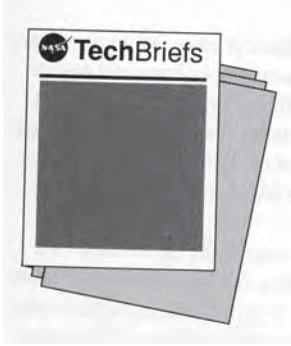
A Complete Description of the Invention is Important

As discussed above under the importance of good recordkeeping, it is very important that a complete description be prepared of your invention. It is much better to have too much description than too little. Keep in mind that the attorney who will prepare your application, while having a degree in Engineering or Science as well as law, is probably not an expert in your particular field. In order to aid the attorney's understanding of your invention, a more detailed description than would be necessary for your colleagues should be prepared. If you have made any proposals, publications, etc., these are generally excellent documents to submit as well.

Assignment of a Case Number

After receipt of the invention disclosure, the Patent Counsel will log-in the disclosure and a "Case Number" (e.g., GRC 17123-1) will be assigned to identify this disclosure throughout its life.

Publication of Invention in NASA Tech Briefs



The Center's Technology Transfer Office, or Awards Liaison Officer, will often arrange for a brief description of the invention to be published in the NASA Tech Briefs magazine after the filing of a patent application on the invention and/or as a means for commercializing the technology. The Tech Briefs article will identify the disclosure by the docket number, state if the invention has been submitted to the PTO, and if the invention is now available for licensing.

Publication of Invention in NASA Patent Abstracts Bibliography

The NASA Patent Abstracts Bibliography (NASA PAB) is an online semiannual NASA publication containing comprehensive abstracts and indexes of NASA-owned inventions covered by U.S. patents. When appropriate and available, the abstract includes a key illustration taken from the patent. Entries are arranged by division and then by category. The current issue and one previous issue are free, other back issues are available through the NASA Center for AeroSpace Information (CASI). This publication also provides links to other NASA sites containing information about patent availability and licensing.

Evaluation of the Invention

Any reported invention for which the Government has the right to obtain either title or a license will be evaluated for NASA interest, including both anticipated Government use and commercial potential.

The evaluation may include sending NASA Form 433 entitled "Invention Evaluation Questionnaire" (IEQ) [see Appendix A-3] to an appropriate evaluator. Other evaluation means, such as a review by panel which may include technical and business experts and/or a commercial assessment prepared by a Contractor may also be utilized. The NASA Patent Counsel and/or the Center's Technology Transfer Office will then use this information to assign a priority or category to the disclosure.

Assignment of a Priority to the Disclosure

Upon receipt of the completed IEQ, commercialization report and/or panel recommendation, the Patent Counsel and/or Technology Transfer Office will analyze this information and assign a priority or category to the invention (for example, P1, P2 or P3; Category A, B or C). A P1 priority (or Category A) denotes an invention of significant enough interest to NASA to warrant the preparation and filing of a patent application by NASA. Some factors which are may support a P1 priority include: (1) Invention has significant market potential (2) Invention has significant potential for improving quality of life, and/or (3) Invention is of such a significant technical nature that a patent would provide NASA and the Center with recognition and prestige (resulting in future programs for the Agency or Center).

A P2 priority (Category B) typically denotes an invention awaiting further information on which to base a final evaluation. This priority will be reviewed at appropriate intervals until a P1 or P3 priority can be assigned. A P3 (Category C) priority denotes an invention not of enough interest to warrant the preparation and filing of a patent application by NASA. A P3 case will typically be inactivated.

If the inventor believes that an incorrect priority has been assigned to the invention, the inventor should immediately contact the Patent Counsel and/or Technology Transfer Office to discuss the matter. There may be circumstances under which an incorrect priority was assigned, such as an inadequate evaluation of the invention or new information available since the submission of the disclosure.

Monetary Awards Available to Inventors

NASA regulations (14 C.F.R. 1240) provide that inventors are eligible for monetary awards upon the recommendation of the NASA Inventions and Contributions Board (ICB). Both NASA employees and employees of NASA contractors are eligible for these awards. These awards come at several different stages in the patenting process; hence, it is possible that one invention could result in several awards. These monetary

awards are submitted to the ICB by the Center's Awards Liason Officer (ALO). More information can be seen at http://icb.nasa.gov.

Award Upon the Filing of a Patent Application

Upon reciept of the PTO Patent application Serial number, the Center ALO may apply for a NASA Patent Application Award from the ICB. An award of $1000 may be made to a sole inventor, or $500 each if there are two or more joint inventors. The triggering event for this initial award is not the issuance of a patent, but the filing of a patent application. For purposes of this initial award, it does not matter whether the sole inventor, or one or more of joint inventors, is an employee of NASA; both NASA employees and employees of NASA contractors are eligible for this award.

NASA Tech Briefs

An ICB award is also given to the inventor when a NASA Tech Brief is approved for publication. Currently, the amount of this award is $350 per author.

Software Release Awards

When software is initially released to a qualified user an ICB award is available. Qualified users include both internal project users or external users (who receive the software through the Center's Software Release Program). Currently, the amount of this award is $1000 for a sole inventor, and $500 for multiple inventors.

Board Action Awards

The ICB may recommend the invention for an award, up to $100,000, based upon such factors as: the aeronautical, space, scientific, technical or humanitarian significance of the invention; the stage of development of the invention; the actual use of the invention by NASA, the Government, or industry; the potential for such use; and the level of creativity involved in making the invention. These awards may be submitted for at any time, however, frequently these factors cannot be evaluated until well after the patent has issued, or the invention has been used for some period of time. Thus, the Center Patent Counsel or any other NASA official (including the inventor himself) may resubmit an invention for the ICB's later consideration of an award when these factors have become clearer.

NASA Invention of the Year Award and Software of the Year Award

Each year the NASA General Counsel selects the NASA Invention of the Year Award winner, from nominees sent from each Center. This award is supported by the ICB with technical assistance, publicity, and monetary awards. The ICB also supports the NASA Software of the Year award, which is co-sponsored by the Office of the Chief Engineer and the Office of Safety and Mission Assurance. For more information on the requirements for these awards the Center ALO should be consulted.

Share of Royalties

In addition to the monetary awards discussed above, the law makes it possible for a NASA inventor to share in the royalties NASA receives from the licensing of the invention. (15 U. S.C. 3701). Unlike the initial and supplemental awards, this royalty sharing applies only to government employees (and independent inventors who have assigned their rights to NASA). Current NASA regulations (NPR 2092.1A) provide that the first $5,000 in royalty income each year is distributed to the inventors. Each inventor also receives 25% of any royalties in excess of $5,000 per year up to the first $25,000 received by NASA, and 30% of any remainder received.

The Patenting Process

Statutory Bars to Patentability

There are seven statutory "bars" to patentability of inventions enumerated in 35 U.S.C.§ 102 [i.e., a patent may not be obtained even though the invention may fall into one of the previously discussed statutory classes]. The most common bar to patentability encountered by NASA inventors is:

The Public Disclosure Bar

Under U.S. law [35 U.S.C. § 102(b)], a patent may not be obtained unless the patent application is filed within 1 year from the date of a publication (or public use) disclosing the invention. In many foreign countries, any publication prior to the patent application is a bar. Thus, in order to avoid this bar, inventions should be disclosed to the Patent Counsel in sufficient time prior to any proposed publication or public use, for evaluation and processing of the application.

Other Bars to Patentability

Other statutory bars include: the applicant did not himself invent the subject matter sought to be patented [§102(f)]; the invention was known or used by others or described in a printed publication before the invention by the applicant [§102(a)]; the invention was abandoned [§ 102(c)]; or that another inventor independently conceived the invention before applicant and diligently reduced it to practice [§102(g)].

The "Obviousness" Bar to Patentability

The invention may also be "obvious" and therefore unpatentable. Obvious modifications to existing technology are barred by 35 U.S.C. § 103. This does not mean that small incremental changes in existing technology are unpatentable however. Most inventions are small improvements, not giant leaps of new technology, such as the first laser was. Therefore, an inventor should not be too quick to discount his invention as "obvious." If there is any doubt, it is best to submit the disclosure to the Patent Counsel for evaluation.

Prior-Art Search

After the invention is evaluated for Government interest, a prior art search may be conducted on P1 priority inventions to determine if there are any existing patents or other publications that would render the invention unpatentable under 35 USC § 102 or § 103. The search is conducted at the PTO in Alexandria, VA, either by the NASA attorney or an outside search firm. The inventor may or may not be requested to assist in the search. The results of the prior art search are often sent to the inventor for evaluation as to the relevance towards the invention.

Application Preparation

If the invention is not barred by 35 U.S.C. §102 or §103, and if the Government has sufficient interest in expending the funds necessary to obtain patent protection, then a patent application will be prepared by the Center's Patent Counsel. All NASA patent attorneys are members of a state bar and are also licensed by the PTO to practice in patent cases before the PTO by passing a rigorous PTO exam on patent procedures. Most patent attorneys also spent several years as an engineer or scientist before becoming a patent attorney.

The application typically consists of three parts: (1) The Specification, (2) The Drawings, and (3) The Claims.

The Specification

The specification is a written description of the invention and includes the manner and process of making and using it and at least one embodiment. The specification must be written so that any person skilled in the art to which the invention pertains can make or use it. It is important that NASA inventors submit as complete a description as possible to the Patent Counsel so that an adequate specification can be prepared.

The Drawings

An applicant for a patent must furnish a drawing where necessary for the understanding of the subject matter sought to be patented. In most inventions disclosed by NASA employees, drawings will be required and they should be as detailed as possible. Although the drawings should be as clear as possible, it is not necessary for the inventor to submit them in the "patent format"; clear and neat sketches are acceptable. When required, the Patent Counsel will have formal drawings prepared by a patent draftsman.

The Claims

The claims appear at the end of the specification and are drafted by the attorney to cover the full scope of the applicant's invention. The claims represent the "metes and bounds" of the invention and define the subject matter which is legally protected by the patent grant. They must particularly point out and distinctly claim the subject matter which the inventor regards as his invention.

Draft Specification Review by Inventor

The attorney assigned to the case will prepare a draft specification for the inventor to review. The inventor is the person most familiar with the technology to which the invention pertains and should ensure that the specification describes the invention, including the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention. The specification must also set forth the best mode contemplated by the inventor of carrying out the invention. As previously discussed, the inventor should pay particular attention to the claims; although the inventor may not be familiar with the form in which the claims are written, it is important that the inventor spend the time necessary to fully understand the scope of the claims.

The draft specification may require several iterations before it is satisfactory to the inventor. The inventor should make as many corrections or changes as necessary to arrive at a satisfactory patent application. The inventor should keep in mind that it is generally better to overdescribe the invention than to run the risk that the PTO will reject the application because the specification is inadequate.

Execution of the Declaration and an Assignment or License

After the attorney and the inventor are satisfied with the specification the inventor will be requested to execute a Declaration and an Assignment for filing with the application in the PTO.

The DECLARATION (see Appendix A-4) states that:

(1) the inventor believes he or she is the original, first and sole inventor (or an original, first and joint inventor) of the subject matter which is claimed and for which a patent is sought on the invention;

(2) the inventor has reviewed and understands the contents of the specification, including the claims;

(3) the inventor acknowledges the duty to disclose to the PTO all information which is known to be material to patentability as defined in 37 CFR §1.56 (the Patent Counsel can explain this further if necessary);

(4) the inventor claims the benefit under 35 U.S.C. §120 of any United States applications(s) listed on the document, insofar as the subject matter of each of the claims of the appliction is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C.§112, and acknowledges the duty to disclose to the PTO all information known to him or her to be material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(5) the inventor is appointing a NASA attorney to prosecute the application and to transact

all business in the PTO connected therewith;

(6) the inventor is certifying that the Government of the United States of America, as represented by the Administrator of the National Aeronautics and Space Administration, has an assignment in, or license to, the invention set forth in the application and that, the Government has the irrevocable right to prosecute the application and to receive the patent;

(7) the inventor asks that Letters Patent be granted for the invention described and claimed in the specification and claims; and

(8) the inventor declares that all statements made in the declaration are of the inventor's own knowledge, are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C.§ 1001, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

The ASSIGNMENT (see appendix A-5) states that in consideration of your employment by the Government you:

(1) Assign to the Government your full and exclusive right in and to the invention within the United States of America, its territories and possessions, and your entire right, title and interest in and to the application, and any corresponding continuation or divisional application(s) and any patent(s) that may issue therefrom;

(2) Agree to grant to the Government your full and exclusive foreign rights in and to the invention, in accordance with 37 CFR § 501.9, including right of priority under the International Convention of Paris (1883), as amended. If the Government chooses not to file an application in any foreign country you may request rights in that country in accordance with the terms set forth in 37 CFR § 501.9, including the reservation of a Government license to the invention; and

(3) Agree, at the expense of the Government,(a) to execute any document for, (b) to deliver any requested information to, and (c) to cooperate in any manner with the Government in order to allow the Government to protect any interest transferred by the Assignment and Agreement.

Filing the Application With the PTO

The full patent application which consists generally of the Specification, Drawings, Claims, Declaration and Assignment will be sent by the Patent Counsel to the PTO which has offices in Crystal City, VA and Alexandria, VA. The PTO will acknowledge receipt of the application, assign a serial number and filing date, determine the proper classification of the invention, and forward the application to an "art unit" for examination.

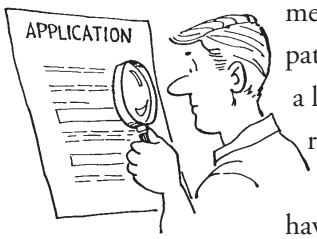
Foreign Filing

A patent is not extraterritorial in effect. The existence of a U.S. patent will not prohibit the practice of the patented invention in a foreign country, even by a U.S. citizen.

NASA conducts a foreign patent program; the regulations establishing policy, criteria, and procedures concerning it are set forth at 14 CFR §1245.300. Patent applications are filed on selected inventions in selected foreign countries, based upon determinations as to the prospects for licensing the potential foreign patent rights. Foreign patent applications must be filed in each country or region in which NASA intends to protect its patent rights and the application must conform with all the rules of patent practice for that country or region.

Foreign patent filing is extremely expensive and is undertaken by NASA only in carefully selected instances. A license may require that the licensee fund all foreign patenting costs. Foreign patent filing must also adhere to the requirements of 35 USC §184, which governs the filing of patent applications in foreign countries.

Examination of the Application



The application is assigned to an examiner in an appropriate art unit for examination of the merits of the invention. The examiner determines whether the application complies with the patent laws, will search the existing prior art, and will make an "Office Action" in the form of a letter in which the examiner may reject some or all of the claims for one or more of the reasons outlined below. For prior art rejections, the examiner will cite prior art references which "anticipate" the claimed invention or show that it would be obvious to a person having ordinary skill in the field of the invention. It is normal to have some or all of the claims rejected on the first examination.

The statutory basis for rejection of the application is one or more of the following:

(1) Rejection based upon 35 U.S.C. §101:

35 U.S.C. §101 states "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor." If the application is rejected under §101, it could be that the invention is directed to non-statutory subject matter, that the invention lacks utility, or that the invention is inoperative and therefore lacks utility. If the inventor is attempting to obtain two patents on one invention, called "double patenting," the application will be rejected under this section.

(2) Rejection based upon 35 U.S.C. §102:

35 U.S.C. § 102 enumerates the seven statutory bars discussed previously. The examiner

will cite the prior art which "anticipates" the invention and explain why the cited prior art discloses all of the features of the invention. Most of the time, the inventor and attorney will be able to modify the claims to "overcome" the examiner's rejection under §102. The examiner could also reject the application under this section if the examiner found a prior publication of the invention that the inventor was unaware of.

(3) Rejection based upon 35 U.S.C. §103:

35 U.S.C. §103 states" A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

This section is where most of the applications are rejected. Usually, the examiner cannot find prior art which totally "anticipates" the invention. Therefore, the examiner combines 2 or more prior art references to arrive at the invention. When this happens, the attorney and inventor will discuss the numerous arguments why the examiner may be incorrect in making the rejection under this section.

(4) Rejection based upon 35 U.S.C. §112:

Section112 deals primarily with the adequacy of the specification, claims, and drawings. Generally, section 112 problems are easy to clear-up, unless the specification is defective; in that case, it may have to be re-written and a new application filed because "new matter" may not be added to the specification after it is filed at the PTO.

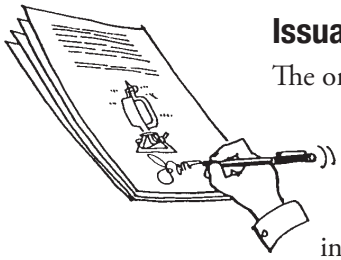
The NASA patent attorney assigned to the case will answer the Office Action on behalf of the inventor, by an Amendment or other appropriate response in the form of a letter within the prescribed period of time, which is usually three months. The Amendment will seek to overcome the examiner's rejections by pointing out reasons why a patent should be granted. The examiner then examines the amended application. This process continues until the inventor's remaining claims are either "finally rejected" or are allowed. "Finally rejected" simply means that the examiner has examined the claims at least twice, and that no further examination will be conducted.

Allowance, Appeal or Abandonment of the Application

If all of the claims in the application are "finally rejected," then the application must either be abandoned, re-filed as permitted or appealed to the PTO Board of Appeals. If some of the claims are allowed and some are "finally rejected," the entire application can be appealed

or the rejected claims can be cancelled which will put the application in condition for allowance.

Once all of the claims in the application (after any amendments and/or cancellations) are allowed, the examiner will send a "Notice of Allowance and Issue Fee Due" to the attorney. This informs the NASA patent attorney that prosecution on the case is over, and that any remaining minor matters (such as the submission of formal patent drawings) must now be corrected. The issue fee must be paid within 3 months of the date of the "Notice of Allowance and Issue Fee Due."



Issuance of the Patent

The original patent grant (See Appendix B-9) will issue in the name of the inventor approximately 3 months after NASA pays the issue fee. If the inventor has assigned all rights to the Government, the original patent grant is sent by the PTO to NASA Headquarters where it is kept until it expires; a copy of the issued patent is sent to all inventors by the Patent Counsel along with a congratulatory letter. If the inventor kept all rights and only gave a license to the Government, the original patent grant will be sent to the inventor's residence. In the case of joint inventors, the original patent grant will be sent to the first named inventor.

Maintenance Fees on Issued Patents

Although the patent is issued for a term of 20 years from application filing date, the PTO charges fees for maintaining the patent in force during the entire 20 year period. These fees are assessed at intervals of 3.5, 7.5 and 11.5 years after the issue date of the patent. NASA may or may not pay the fees depending on the commercial value of the patent at the time the maintenance fee becomes due. On those patents for which NASA has only a license, payment of the maintenance fees is the responsibility of the inventor.

Correction of Issued Patents

When the inventor receives a copy of the issued patent, the inventor should carefully review the specification, claims and drawings for any mistakes. If any significant mistakes are noted, the inventor should inform the Patent Counsel who will arrange for a "certificate of correction" to be issued by the PTO.

Expiration of the Patent Grant

The patent grant will expire 20 years following its application filing date or earlier, depending upon the payment of the maintenance fees. After the expiration of the patent grant, the inventor who assigned all rights to the Government may receive the original grant from NASA Headquarters and any member of the public is then free to use the invention without interference.

Licensing NASA Patents

More than 30,000 products and technologies have evolved from the space program since 1958. Some examples are:

Graphite Composites
- developed for spacecraft, the material's strength and lightness is used in tennis rackets, fishing poles and golf clubs.

Heated Ski Goggles
- adapted from helmets used for space walks.

Athletic Shoes
- special wedged heel developed for moon walkers.

Burglar Alarm
- detects human movement.

Freeze-Dried Food
- first used during astronaut John Glenn's 1962 Mercury orbits.

Other spinoffs include: Liquid Crystal Watches, Smoke Detectors, Solar Calculators, Automatic Teller Machines, Drunk Driver Testing devices, Offshore Oil Rigs, Heart-monitoring Exercise Equipment, Metallized Emergency Blankets, Airport Luggage X-ray Machines, and Solar Heating Systems.

NASA presently owns over 3000 and patent applications which protect inventions in hundreds of subject matter categories. NASA has the authority to grant licenses on federally owned inventions pursuant to 35 USC§ 207-209. This statutory authority is implemented by 37 CFR Part 404.

All patent licenses granted by NASA are individually negotiated with the prospective licensee, and each license contains terms as to commercialization, license duration, royalties, and periodic reporting. NASA licenses may be exclusive, partially exclusive, or nonexclusive.

Technical assistance from NASA personnel for selected inventions may be made available by NASA. This is generally on a reimbursable basis, and is generally negotiated by the licensee directly with the Field Center where the invention was made.

An application for the license of a NASA invention is initiated by the applicant sending an application to the Center where the invention originated. The application should include a

development plan and other matters stated in 37 CFR 404.8. The applicant should also propose a royalty payment. The license will be negotiated at the Center and the Patent Counsel will make a recommendation to NASA Headquarters to grant, deny, or further negotiate modifications to the proposed license. The Agency Counsel for Intellectual Property then makes a recommendation to the Headquarters General Counsel, who makes the final decision for NASA.

For exclusive and partially exclusive licenses, 37 CFR 404.7 requires an additional step before the final determination to grant a license can be made. A notice of the prospective license must generally be placed in the Federal Register identifying the invention and prospective licensee, and provide for a minimum 15-day period for the public to file written objections. 37 CFR 404.11 provides an appeal procedure to the NASA administrator for license applicants aggrieved by the decision of the General Counsel.

Patent Infringement

The word "infringement" means an encroachment upon the domain belonging to a patentee that is described by the claims of his patent. If a patent is analogized to real property, the claims correspond to the boundary recited in the deed. Invasion of the boundary of a landowner's real estate is called trespass, while invasion of a patentee's claims is called infringement. Both are civil wrongs or "torts." Unlike a trespass, patent infringement is a statutory wrong and is governed by federal law. 35 U.S.C. §271 defines infringement as "Whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent therefor, infringes the patent."

A determination of patent infringement involves a two-step process. First, the claims are analyzed by studying all of the relevant patent documents. Second, the claims must "read on" the accused device or process. This merely means that the device or process is examined to see if it is substantially described by the claims; in other words, the claims are tested to see whether they describe the accused infringement.

Infringement can be direct, indirect, or contributory. Anyone who makes, uses, offers to sell, sells, or imports into the United States the patented invention is a direct infringer. If a person actively encourages another to make, use or sell the invention, the person so inducing is liable for indirect infringement. Contributory infringement can be committed by knowingly selling or supplying an item for which the only use is in connection with a patented invention. Good faith or ignorance is no defense for direct infringement, but it can be for indirect or contributory infringement.

The remedies for infringement consist of: (1) injunctive relief, (2) damages (including treble

damages for willful infringement), (3) attorneys' fees in some cases, and (4) court costs.

By the Government

Infringement, by the Government, of privately owned patents, is governed by 28 U.S.C. § 1498, which provides that a suit against the Government in the U.S. Court of Federal Claims is the exclusive remedy for patent holders who allege their patented invention has been infringed by the U.S. Government or by one acting for the Government. The primary purpose of this statute is to protect and relieve contractors from any liability for infringement by the owner when an invention is used by or manufactured for the United States. By virtue of this statute, the Government may be held liable to the patent owner for payment of the "reasonable and entire compensation" for its unauthorized use of the patent. Unlike a private party however, the government cannot commit the tort of "patent infringement." Governmental use of a patented invention is viewed as an eminent domain taking of a license under the patent and not as a tort.

The Government may delegate its eminent domain power over patents to contractors acting on its behalf. This is accomplished through inclusion of the "Authorization and Consent" clause in the contract [FAR clause 52.227-1]. This clause is usually included in research and development contracts and is a very significant power to grant to a contractor as it makes the Government responsible for the contractors infringement of any patents during the course of performance of the contract; the patent owner must bring his action against the government, not the contractor.

Sometimes the Government does not wish to fully delegate its eminent domain power to a contractor. This is accomplished by inclusion in the contract of the "Patent Indemnity" clause [FAR clause 52.227-3] which obligates the contractor who infringes a patent to indemnify the Government for any liability it incurs.

Appendix A
Sample Patent Forms

National Aeronautics and Space Administration

Patent Rights Questionnaire

NASA CASE NO.

INSTRUCTIONS

1. In order that a determination be made of the respective rights of the Government and its employees to an invention, it is necessary that certain information be provided by the employee-inventors relative to the conditions under which the invention was made.

2. If the inventors recognize that the Government is entitled to all rights to the invention, only the Agreement to Assign need be executed by the inventors and this form returned directly to this office.

3. If, however, the inventors believe that title should be retained by them, but are willing to grant a license to the Government, then each inventor is to execute an Agreement to License by completing items 1 through 4 and item 7 of individual forms.

4. If the inventors believe the Government not to be entitled to any rights, then each inventor is to complete items 1 through 6 of individual forms.

5. In the last two situations (Paragraphs 3 and 4 above) the form is to be returned via the inventor's immediate supervisor, who should include his or her concurrence or comments in item 8.

DESCRIPTIVE TITLE OF INVENTION

INVENTOR(S)	EMPLOYER

AGREEMENT TO ASSIGN

I (WE) THE UNDERSIGNED INVENTOR(S) DO HEREBY AGREE TO ASSIGN ALL RIGHTS IN AND TO THE INVENTION TO THE GOVERNMENT.

SIGNATURE	DATE	SIGNATURE	DATE

AGREEMENT TO LICENSE

1. STATUS AND PLACE OF EMPLOYMENT DURING TIME INVENTION WAS MADE *(Civil Service grade, position title and where employed)*

2. NATURE OF YOUR EMPLOYMENT DURING THE TIME THE INVENTION WAS CONCEIVED AND REDUCED TO PRACTICE *(Check)*

EMPLOYED OR ASSIGNED TO	YES	NO
a. IMPROVE OR PERFECT OR INVENT ANY ART, MACHINE, MANUFATURE, DESIGN, OR COMPOSITION OF MATTER		
b. CONDUCT OR PERFORM RESEARCH OR DEVELOPMENT		
c. SUPERVISE, DIRECT, COORDINATE OR REVIEW GOVERNMENT FINANCED OR CONDUCTED RESEARCH OR DEVELOPMENT		
d. ACT IN A LIAISON CAPACITY AMONG GOVERNMENTAL OR NON-GOVERNMENTAL AGENCIES OR INDIVIDUALS ENGAGED IN SUCH RESEARCH OR DEVELOPMENT		

3. ASSIGNED DUTIES AT THE TIME INVENTION WAS MADE *(Discuss with particular and detailed reference to the project or area of work most closely related to the invention)*

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AGREEMENT TO LICENSE *(Continued)*

4. ADDITIONAL FACTS OR CIRCUMSTANCES WHICH YOU BELIEVE MAY HAVE A BEARING ON EITHER THE GOVERNMENT'S OR YOUR RIGHTS IN THE INVENTION

5. EXTENT OF CONTRIBUTION IN THE MAKING OF THE INVENTION *(Enter the hours and percentages as appropriate)*

DESCRIPTION	GOV'T	OWN
a. TIME *(Hours)*		
b. FACILITIES *(Percentage)*		
c. EQUIPMENT *(Percentage)*		
d. MATERIALS *(Percentage)*		
e. FUNDS *(Percentage)*		
f. INFORMATION AVAILABLE ONLY BY REASON OF INVENTOR'S OFFICIAL DUTIES *(Percentage)*		
g. TIME OR SERVICES OF OTHER GOVERNMENT EMPLOYEES ON OFFICIAL DUTY *(Hours)*		

6. PREPARED BY	a. SIGNATURE OF INVENTOR	b. DATE

7. AGREEMENT

I, THE UNDERSIGNED INVENTOR, DO HEREBY AGREE TO GRANT THE GOVERNMENT A NON-EXCLUSIVE, IRREVOCABLE, ROYALTY-FREE LICENSE IN THE INVENTION FOR GOVERNMENTAL PURPOSES.

a. SIGNATURE OF INVENTOR	b. DATE

8. SUPERVISORY ENDORSEMENT

a. CONCURRENCE OR COMMENTS

b. SIGNATURE OF INVENTOR'S SUPERVISOR	c. TITLE	d. DATE

FOR USE OF PATENT REPRESENTATIVE

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National Aeronautics and Space Administration

Disclosure of Invention and New Technology (Including Software)

Form Approved O.M.B. NO. 2700-0009	DATE
CONTRACTOR CASE NO.	
NASA CASE NO. (OFFICIAL USE ONLY)	

This is an important legal document. Carefully complete and forward to the Patent Representative (NASA in-house innovation) or New Technology Representative (contractor/grantee innovation) at NASA. Use of this report form by contractor/grantee is optional; however, an alternative format must at a minimum contain the information required herein. NASA in-house disclosures should be read, understood and signed by a technically competent witness in the witness signature block at the end of this form. In completing each section, use whatever detail deemed appropriate for a "full and complete disclosure." Contractors/Grantees please refer to the New Technology or Patent Rights Retention by the Contractor clauses. When necessary, attach additional documentation to provide a full, detailed description.

1. DESCRIPTIVE TITLE

2. INNOVATOR(S) *(For each innovator provide: Name, Title, Phone Number, E-mail Address, and Home Address. For non U.S. citizens, include INS Form I-551 No. and expiration date. If multiple innovators, number each to match Box 5.)*

3. INNOVATOR'S EMPLOYER WHEN INNOVATION MADE *(For each innovator provide: Name, Division and Address of Employer, Organizational Code/Mail Code, and Contract/Grant Number if applicable. If multiple innovators, number each to match Box 5.)*

4. PLACE OF PERFORMANCE *(Address(es) where innovation made)*

5. EMPLOYER STATUS *(choose one for each innovator)*

_____ Innovator #1 _____ Innovator #3

_____ Innovator #2 _____ Innovator #4

GE = Government
CU = College or University
NP = Non-Profit Organization
SB = Small Business Firm
LE = Large Entity

6. ORIGIN *(Check all that apply and provide all applicable numbers. If multiple Contracts/Grants, etc., list Contract/Grant Numbers in Box 3 with applicable employer information.)*

- ☐ NASA In-house Org. Mail Code _____
- ☐ Grant/Cooperative Agreement No. _____ UPN _____
- ☐ Prime Contract No. _____ UPN _____
  Task No. _____ Report No. _____
- ☐ Subcontractor; Subcontract Tier _____ UPN _____
- ☐ Joint Effort (*contractor, subcontractor and/or grantee contribution(s), and NASA in-house contribution*)
- ☐ Multiple Effort (*multiple contractor, subcontractor and/or grantee contributions, no NASA in-house contribution*)
- ☐ Other (*e.g., Space Act Agreement, MOA*) No._____

7. NASA CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE *(COTR)*

8. CONTRACTOR/GRANTEE NEW TECHNOLOGY REPRESENTATIVE *(POC)*

9. BRIEF ABSTRACT *(A general description of the innovation which describes its capabilities, but does not reveal details that would enable duplication or imitation of the innovation.)*

SECTION I – DESCRIPTION OF THE PROBLEM OR OBJECTIVE THAT MOTIVATED THE INNOVATION'S DEVELOPMENT ***(Enter as appropriate: A. – General description of problem/objective; B. – Key or unique problem characteristics; C. – Prior art, i.e., prior techniques, methods, materials, or devices performing function of the innovation, or previous means for performing function of software; and D. – Disadvantages or limitation of prior art.)***

SECTION II – TECHNICALLY COMPLETE AND EASILY UNDERSTANDABLE DESCRIPTION OF INNOVATION DEVELOPED TO SOLVE THE PROBLEM OR MEET THE OBJECTIVE ***(Enter as appropriate; existing reports, if available, may form a part of the disclosure, and reference thereto can be made to complete this description: A. – Purpose and description of innovation/software; B. – Identification of component parts or steps, and explanation of mode of operation of innovation/software preferably referring to drawings, sketches, photographs, graphs, flow charts, and/or parts or ingredient lists illustrating the components; C. – Functional operation; D. – Alternate embodiments of the innovation/software; E. – Supportive theory; F. – Engineering specifications; G. – Peripheral equipment; and H. – Maintenance, reliability, safety factors.)***

SECTION III – UNIQUE OR NOVEL FEATURES OF THE INNOVATION AND THE RESULTS OR BENEFITS OF ITS APPLICATION ***(Enter as appropriate: A. – Novel or unique features; B. – Advantages of innovation/software; C. – Development or new conceptual problems; D. – Test data and source of error; E. – Analysis of capabilities; and F. – For software, any re-use or re-engineering of existing code, use of shareware, or use of code owned by a non-federal entity.)***

SECTION IV – SPECULATION REGARDING POTENTIAL COMMERCIAL APPLICATIONS AND POINTS OF CONTACT ***(Including names of companies producing or using similar products.)***

10. ADDITIONAL DOCUMENTATION *(Include copies or list below any pertinent documentation which aids in the understanding or application of the innovation (e.g., articles, contractor reports, engineering specs, assembly/manufacturing drawings, parts or ingredients list, operating manuals, test data, assembly/manufacturing procedures, etc.).)*

TITLE	PAGE	DATE

11. DEGREE OF TECHNOLOGY SIGNIFICANCE *(Which best expresses the degree of technological significance of this innovation?)*

☐ Modification to Existing Technology ☐ Substantial Advancement in the Art ☐ Major Breakthrough

12. STATE OF DEVELOPMENT

☐ Concept Only ☐ Design ☐ Prototype ☐ Modification ☐ Production Model ☐ Used in Current Work

13. PATENT STATUS (Prior patent on/or related to this innovation.)

☐ Application Filed Application No. _____ Application Date _____

☐ Patent Issued Patent No. _____ Issue Date _____

14. INDICATE THE DATE OR THE APPROXIMATE TIME PERIOD WHICH THIS INNOVATION WAS DEVELOPED *(i.e., conceived, constructed, tested, etc.)*

15. PREVIOUS OR CONTEMPLATED PUBLICATION OR PUBLIC DISCLOSURE INCLUDING DATES *(Provide as applicable: A. – Type of publication or disclosure, e.g., report, conference or seminar, oral presentation; B. – Disclosure by NASA or Contractor/Grantee; and C. – Title, volume no., page no., and date of publication.)*

16. QUESTIONS FOR SOFTWARE ONLY

(a) Using non-NASA employees to beta-test the program? ☐ YES ☐ NO If Yes, done under a beta-test agreement? ☐ YES ☐ NO

(b) Modification of this program continue by civil servant and/or contractual agreement? ☐ YES ☐ NO

(c) Copyright registered? ☐ YES ☐ NO ☐ UNKNOWN If Yes, then by whom? _____

(d) Has the latest version been distributed outside of NASA or contractor? ☐ YES ☐ NO ☐ UNKNOWN
If Yes, date of first disclosure: _____

(e) Were prior versions distributed outside of NASA or Contractor? ☐ YES ☐ NO If Yes, supply NASA or contractor contract: _____

(f) Contains or based on code not owned by U.S. Government or its contractors? ☐ YES ☐ NO ☐ UNKNOWN
If Yes, name of code and code's owner: _____
Has a license for use been obtained? ☐ YES ☐ NO ☐ UNKNOWN

17. DEVELOPMENT HISTORY

STAGE OF DEVELOPMENT	DATE (MM/YYYY)	LOCATION	IDENTIFY SUPPORTING WITNESSES (NASA in-house only)
a. First disclosure to others			
b. First sketch, drawing, logic chart or code			
c. First written description			
d. Completion of first model of full size device *(invention)* or beta version *(software)*			
e. First successful operational test *(invention)* or alpha version *(software)*			

f. Contribution of innovators *(if jointly developed, provide the contribution of each innovator)*

g. Indicate any past, present, or contemplated government use of the innovation

18. SIGNATURES OF INNOVATOR(S), WITNESS(ES), AND NASA APPROVAL

TYPED NAME AND SIGNATURE *(Innovator #1)*	DATE	TYPED NAME AND SIGNATURE *(Innovator #2)*	DATE
TYPED NAME AND SIGNATURE *(Innovator #3)*	DATE	TYPED NAME AND SIGNATURE *(Innovator #4)*	DATE
TYPED NAME AND SIGNATURE *(Witness #1)*	DATE	TYPED NAME AND SIGNATURE *(Witness #2)*	DATE
NASA APPROVED ▶ TYPED NAME		SIGNATURE	DATE

NASA FORM 1679 JUL 2000 PREVIOUS EDITION IS OBSOLETE. **Page 4 of 4**

National Aeronautics and Space Administration

Invention Evaluation Questionnaire

DATE

NASA CASE NO.

TO:

FROM:

INSTRUCTIONS

The attached invention disclosure relating to subject matter under your technical cognizance is submitted for your review. Completion and return of this questionnaire and the attached materials *within two weeks* will allow a prompt evaluation of the extent of NASA's interest in obtaining patent protection, commercial dissemination, etc. of the disclosed invention. Your remarks may be noted in longhand if desired.

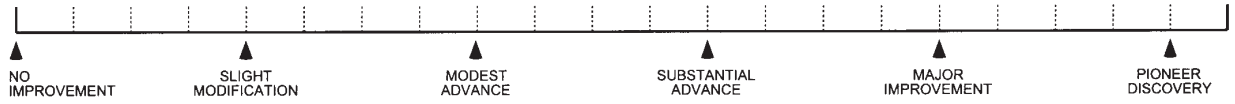
TITLE OF INVENTION

INVENTOR(S)

CONTRACTOR

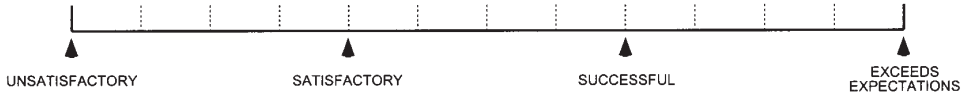
1. SIGNIFICANCE *(The relative importance of the invention in its field of Technology)*

Check the appropriate position on the spectrum.



2. PERFORMANCE *(The performance of the invention)*

Check the appropriate position on the spectrum. If "Undetermined," check the box provided and indicate when evaluation will be possible.



☐ UNDETERMINED. *If undetermined, evaluation will be possible by* _____

(Approximate Date)

3. USE *(Used by, or potential use by, NASA, Other Government Agencies and Private Industry)*

a. NASA

(1) NATURE OF USE *(Check the appropriate block)*

☐ (a) Currently in Operational Use ☐ (b) Future Operational Use Contemplated ☐ (c) No Operational Use Contemplated

(2) WHERE USED AND EXTENT *(If a(1)(a) or a(1)(b) was checked, give location and extent (quantity) invention is being or will be used*

b. OTHER GOVERNMENT AGENCIES

(1) NATURE OF USE *(Check the appropriate block)*

☐ (a) Currently in Operational Use ☐ (b) Future Operational Use Contemplated ☐ (c) No Operational Use Contemplated

(2) WHERE USED AND EXTENT *(If b(1)(a) or b(1)(b) was checked, give name of agency and extent (quantity) invention is being or will be used.)*

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3. USE *(Continued)*

c. PRIVATE INDUSTRY *(Commercial Potential)*

(1) COMMERCIAL APPLICATION *(Check the appropriate block)*

☐ (a) Has Commercial Application ☐ (b) No Known Commercial Application

(2) IF c(1)(a) HAS BEEN CHECKED, SPECIFY TYPE OF PRODUCT OR PROCESS IN WHICH THE PRODUCT IS LIKELY TO BE UTILIZED.

(3) IF c(1)(a) HAS BEEN CHECKED, COULD THE PRODUCT OR PROCESS BE TRANSFERRED TO A COMMERCIAL LINE? *(Check the appropriate block)*

☐ (a) In existing form or with minor modification

☐ (b) With moderate modification

☐ (c) Only with extensive further development

(4) MARKET *(If c(1)(a) has been checked, what would be the extent or the potential commercial market for the product or process? Check the appropriate position on the spectrum.)*

(5) COMMENT *(Give additional comments concerning the commercialization of the product or process.)*

4. FUNDS

a. COST TO REPRODUCE THE SPECIFIC INVENTION *(Approximate)*	$
b. COST OF THE SYSTEM OF WHICH THE INVENTION IS A COMPONENT *(If applicable)*	$

5. VERIFICATION OF LISTING OF INVENTORS

Check the appropriate block

☐ a. ABOVE LISTING IS COMPLETE ☐ b. ABOVE LISTING IS INCOMPLETE

6. CERTIFICATION

I HAVE REVIEWED THE ABOVE IDENTIFIED INVENTION AND, BASED ON CONSIDERATIONS WHICH INCLUDE SUCH FACTORS AS TECHNOLOGICAL SIGNIFICANCE, GOVERNMENTAL USE OR PROSPECTIVE USE, AND ACTUAL OR PROSPECTIVE COMMERCIAL OR INDUSTRIAL APPLICATION, BELIEVE THAT THE INVENTION

☐ IS ☐ IS NOT OF SIGNIFICANT INTEREST TO THE GOVERNMENT.

7. EVALUATED BY	a. SIGNATURE AND TITLE	b. DATE

FOR USE OF PATENT REPRESENTATIVE

EVALUATION OF COMMENTS

INITIAL EVALUATION	SIGNATURE OF ATTORNEY	DATE

NASA FORM 433 SEP 96 PREVIOUS EDITIONS ARE OBSOLETE.

National
Aeronautics and
Space
Administration

Patent Application

_____
(NASA Case No.)

Declaration, Power of Attorney and Petition - Original Application

As a below named inventor, I hereby declare that: My residence, mailing address and citizenship, are stated below next to my name, I believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled

_____

_____

the specification of which ☐ is attached hereto, ☐ was filed on *(Date)* _____

as Application Serial No. _____ and was amended *(Date)* _____ .

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Patent and Trademark Office all information which is known to me to be material to patentability as defined in 37 CFR §1.56.

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

_____ , _____ , the status of which is ☐ patented, ☐ pending, ☐ abandoned.
(Serial No.) *(Filing Date)*

I hereby claim priority benefits under Title 35, United States Code §119(e) of any United States Provisional Applications listed below:

_____ , _____ , the status of which is pending.
(Provisional Serial No.) *(Filing Date)*

POWER OF ATTORNEY: I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Registered practitioner(s) at Customer Number _____ , OR

☐ Registered practitioner(s) listed below:

_____ *(Name)*	_____ *(Reg. No.)*	_____ *(Name)*	_____ *(Reg. No.)*
_____ *(Name)*	_____ *(Reg. No.)*	_____ *(Name)*	_____ *(Reg. No.)*
_____ *(Name)*	_____ *(Reg. No.)*	_____ *(Name)*	_____ *(Reg. No.)*

ADDRESS ALL CORRESPONDENCE TO:

☐ Customer Number _____ , OR

☐ Correspondence Address listed below:

Name: _____

Address: _____

_____

_____

DIRECT TELEPHONE CALLS TO:

Telephone *(Complete number to be dialed from USPTO):*

_____

_____

NASA FORM 1538 DEC 2000 PREVIOUS EDITIONS ARE OBSOLETE.

____
(NASA Case No.)

Further, as a named inventor, I certify that the Government of the United States of America, as represented by the Administrator of the National Aeronautics and Space Administration has ☐ an assignment in, or ☐ license to the invention set forth in this application and has the irrevocable right to prosecute this application and to receive the patent.

Wherefore, I pray that Letters Patent be granted to me for this invention or discovery described and claimed in the foregoing specification and claims, and I hereby subscribe my name to the foregoing specification, claims, power of attorney and this petition.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001; and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

NASA FORM 1538 DEC 2000 PREVIOUS EDITIONS ARE OBSOLETE.

____
(NASA Case No.)

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

FULL NAME OF INVENTOR	LAST	FIRST	MIDDLE OR INITIAL
RESIDENCE AND CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP USA
MAILING ADDRESS	STREET NO. AND NAME	CITY AND STATE *(OR COUNTRY)*	ZIP CODE
SIGNATURE			DATE

National Aeronautics and Space Administration

Assignment to the Government (by Government Employee)

Title of Invention: _____

_____

Inventor(s): _____

_____

NASA Case No.: _____ Application No.*: _____ Filing Date*: _____

WHEREAS, the parties to this Assignment and Agreement are the undersigned inventor(s) and the United States Government (hereafter Government), as represented by the Administrator of the National Aeronautics and Space Administration;

WHEREAS, the making of this Assignment and Agreement is in accordance with 37 CFR Part 501; and

WHEREAS, the undersigned inventor(s) has (have) executed, on the date(s) indicated below, an application for United States Patent on the above-entitled invention.

NOW THEREFORE, in consideration of employment by the Government, the undersigned hereby:

1. Assign to the Government my (our) full and exclusive right in and to said invention within the United States of America, its territories and possessions, and my (our) entire right, title and interest in and to said application, and any corresponding continuation or divisional application(s) and any patent(s) that may issue therefrom.

2. Agree to grant to the Government my (our) full and exclusive foreign rights in and to said invention, in accordance with 37 CFR 501.9(d), including rights of priority under the International Convention of Paris (1883), as amended. If the Government chooses not to file an application in any foreign country, I (we) may request rights in that country, in accordance with 37 CFR 501.9(d), and such rights will be subject to the reservation to the Government of a nonexclusive, irrevocable, royalty-free license in the invention with power to grant licenses for all governmental purposes. The terms of such reservation will appear, where practicable, in any foreign patent which may issue on such invention.

3. Agree, at the expense of the Government, (a) to execute any document for, (b) to deliver any requested information to, and (c) to cooperate in any manner with the Government in order to allow the Government to protect any interest transferred by this Assignment and Agreement.

*4. Authorize and request the attorneys of record in the application to insert the application number and filing date above when required.

_____ _____ _____
(Signature of Inventor) *(Date Assignment Executed)* *(Date Application Executed)*

_____ _____
(Inventor's Typed Name) *(Mailing Address - Including Country)*

_____ _____ _____
(Signature of Inventor) *(Date Assignment Executed)* *(Date Application Executed)*

_____ _____
(Inventor's Typed Name) *(Mailing Address - Including Country)*

_____ _____ _____
(Signature of Inventor) *(Date Assignment Executed)* *(Date Application Executed)*

_____ _____
(Inventor's Typed Name) *(Mailing Address - Including Country)*

NASA FORM 430 DEC 2000 PREVIOUS EDITIONS ARE OBSOLETE.

Title of Invention: ______________________________

____

Inventor(s): ______________________________

____

NASA Case No.: __________ Application No.*: __________ Filing Date*: __________

(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	
(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	
(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	
(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	
(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	
(Signature of Inventor)	*(Date Assignment Executed)*	*(Date Application Executed)*
(Inventor's Typed Name)	*(Mailing Address - Including Country)*	

Appendix B
Sample Patents

US006972056B1

(12) **United States Patent**
Delzeit et al.

(10) **Patent No.: US 6,972,056 B1**
(45) **Date of Patent: Dec. 6, 2005**

(54) **CARBON NANOTUBE PURIFICATION**

(75) Inventors: **Lance D. Delzeit**, Sunnyvale, CA (US); **Clement J. Delzeit**, Dodge City, KS (US)

(73) Assignee: **The United States of America as represented by the Administration of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 253 days.

(21) Appl. No.: **10/135,013**

(22) Filed: **Apr. 25, 2002**

(51) **Int. Cl.**[7] **B08B 7/04**
(52) **U.S. Cl.** **134/1**; 134/1; 134/2; 134/22.11; 134/22.15
(58) **Field of Search** ..... 134/1, 2, 22.11, 134/22.15, 19, 25.4; 427/534, 535, 444, 903; 423/447.1, 447.2, 447.3, 445 B

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,641,466	A *	6/1997	Ebbesen et al.	423/447.2
6,752,977	B2 *	6/2004	Smalley et al.	423/447.1
2002/0092984	A1 *	7/2002	Colbert et al.	250/306
2003/0042128	A1 *	3/2003	Harutyunyan et al.	204/158.2

OTHER PUBLICATIONS

Gorelik et al,. Purification Procedures for Single-Wall Carbon Nanotubes, NASA/CR-2000-208926, May, 2001.*
Hernadi et al., "Reactivity of different kinds of carbon during oxidative purification of catalytically prepared carbon nanotubes" Solid State Ionics 141-142, pp. 203-209, 2001.*
Tohji et al., "Extraction of exotic fullerenes and purification of single-walled nanotubes," Fullerene Science and Tecnology vol. 7, No. 4, pp. 665-679, Jul. 1999.*
Ko et al., "Highly efficient microwave-assisted purification of multiwalled carbon nanotubes," Microelectronic Engineering 73-74, pp. 570-577, Jun. 2004.*
S.B. Hawthorne et al, "Extraction of Organic Pollutants from Env." Analytical Chemistry, vol. 66 (1994) pp. 2912-2920.
G.L. Bakker et al, "Surface Cleaning and Carbonaceous Film . . . " Jour Electrochem Soc. vol. 145 (1998) pp. 284-291.
Young Soo Park et al, "High yield purification of multiwalled . . . " Carbon vol. 39 (2001) pp. 655-661.
M. Monthioux et al, "Sensitivity of single wall carbon nanotubes" Carbon vol. 39 (2001) pp. 1251-1272.
R. Andrews et al, "Purification and structural annealing of . . . " Carbon vol. 39 (2001) pp. 1681-1687.
P.X. Hou et al, "Multi-step purification of carbon nanotubes" Carbon vol. 40 (2002) pp. 81-85.

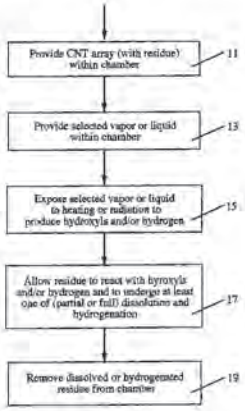
(Continued)

Primary Examiner—Alexander Markoff
(74) *Attorney, Agent, or Firm*—Robert M. Padilla; John F. Schipper

(57) **ABSTRACT**

A method for cleaning or otherwise removing amorphous carbon and other residues that arise in growth of a carbon nanotube (CNT) array. The CNT array is exposed to a plurality of hydroxyls or hydrogen, produced from a selected vapor or liquid source such as H_2O or H_2O_2, and the hydroxyls or hydrogen (neutral or electrically charged) react with the residues to produce partly or fully dissolved or hydrogenated or hydroxylizated products that can be removed or separated from the CNT array. The hydroxyls or hydrogen can be produced by heating the CNT array, residue and selected vapor or liquid source or by application of an electromagnetic excitation signal with a selected frequency or range of frequencies to dissociate the selected vapor or liquid. The excitation frequency can be "chirped" to cover a selected range of frequencies corresponding to dissociation of the selected vapor or liquid. Sonication may be used to supplement dissociation of the H_2O and/or H_2O_2.

2 Claims, 7 Drawing Sheets



US007071741B2

(12) **United States Patent**
Palumbo

(10) **Patent No.: US 7,071,741 B2**
(45) **Date of Patent: Jul. 4, 2006**

(54) **INTERRUPT-BASED PHASE-LOCKED FREQUENCY MULTIPLIER**

(75) Inventor: **Daniel L. Palumbo**, Newport News, VA (US)

(73) Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 78 days.

(21) Appl. No.: **10/943,825**

(22) Filed: **Sep. 17, 2004**

(65) **Prior Publication Data**

US 2006/0061396 A1 Mar. 23, 2006

(51) **Int. Cl.**
H03B 19/00 (2006.01)

(52) **U.S. Cl.** **327/116**; 327/159; 327/160

(58) **Field of Classification Search** 327/116, 327/119, 159, 160

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,916,175 A * 10/1975 Lauer et al. 708/103
4,941,160 A * 7/1990 Sheahan 377/28
5,719,510 A * 2/1998 Weidner 327/119
5,729,166 A * 3/1998 May et al. 327/116
6,657,463 B1 * 12/2003 Velez 327/116

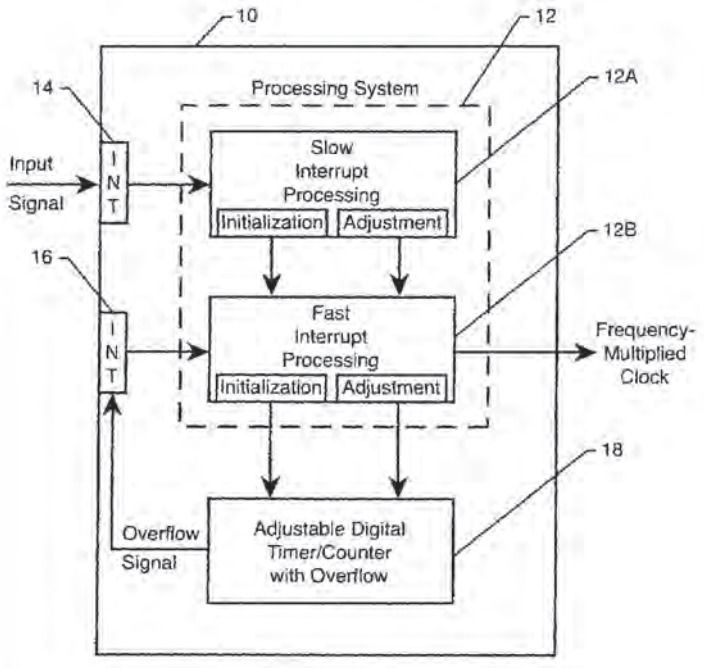
* cited by examiner

Primary Examiner—Kenneth B. Wells
(74) *Attorney, Agent, or Firm*—Helen M. Galus

(57) **ABSTRACT**

A method and system utilize a processor's digital timer and two interrupts to form a frequency multiplier. The first interrupt's processing time window is definable by a first number of counts C_1 of the digital timer while the second interrupt's processing time window is definable by a second number of counts C_2 of the digital timer. A count value CV utilized by the system/method is based on a desired frequency multiplier N, the timer clock rate, and the time required for one cycle of an input signal. The first interrupt is triggered upon completion of one cycle of the input signal at which point the processing time window associated therewith begins. The second interrupt is triggered each time the timer's overflow signal is generated at which point the processing time window associated with the second interrupt begins. During the occurrence of the second interrupt's processing, the count value CV is modified to maintain the first interrupt's processing time window approximately centered between two of the second interrupt's processing time windows.

18 Claims, 2 Drawing Sheets



US006969486B1

(12) **United States Patent**
Cooper et al.

(10) **Patent No.: US 6,969,486 B1**
(45) **Date of Patent: Nov. 29, 2005**

(54) **APPARATUS AND METHOD FOR TREATING POLLUTANTS IN A GAS USING HYDROGEN PEROXIDE AND UV LIGHT**

(75) Inventors: **Charles David Cooper**, Maitland, FL (US); **Christian Anthony Clausen**, Chuluota, FL (US)

(73) Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 709 days.

(21) Appl. No.: **10/056,842**

(22) Filed: **Jan. 18, 2002**

Related U.S. Application Data

(60) Provisional application No. 60/267,401, filed on Feb. 7, 2001.

(51) **Int. Cl.**[7] **A61L 2/00**
(52) **U.S. Cl.** **422/4**; 422/23; 422/24; 422/186.3; 423/210
(58) **Field of Search** 422/4, 23, 24, 422/186.3; 423/210

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,009,252	A *	2/1977	Izumi et al.	423/584
4,012,321	A	3/1977	Koubek	210/63
4,344,918	A *	8/1982	Takahashi	422/80
4,849,114	A	7/1989	Zeff et al.	210/747
5,129,212	A *	7/1992	Duffey et al.	53/426
5,168,193	A *	12/1992	Hoegler	313/113
5,256,379	A *	10/1993	DeLoach	422/186.3
5,439,595	A	8/1995	Downey, Jr.	210/748
5,470,480	A	11/1995	Gray et al.	210/632
5,670,122	A	9/1997	Zamansky et al.	423/210
6,047,543	A	4/2000	Caren et al.	60/275
6,264,899	B1	7/2001	Caren et al.	422/186.3

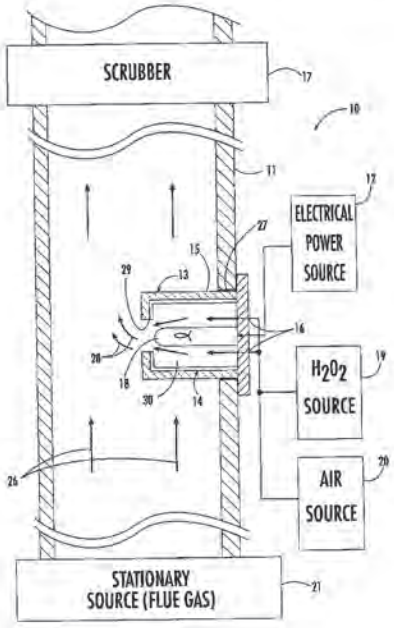
* cited by examiner

Primary Examiner—John Kim
Assistant Examiner—Brad Chin
(74) *Attorney, Agent, or Firm*—Randall M. Heald; Gary G. Borda; Guy Miller

(57) **ABSTRACT**

An apparatus for treating pollutants in a gas may include a source of hydrogen peroxide, and a treatment injector for creating and injecting dissociated hydrogen peroxide into the flow of gas. The treatment injector may further include an injector housing having an inlet, an outlet, and a hollow interior extending therebetween. The inlet may be connected in fluid communication with the source of hydrogen peroxide so that hydrogen peroxide flows through the hollow interior and toward the outlet. At least one ultraviolet (UV) lamp may be positioned within the hollow interior of the injector housing. The at least one UV lamp may dissociate the hydrogen peroxide flowing through the tube. The dissociated hydrogen peroxide may be injected into the flow of gas from the outlet for treating pollutants, such as nitrogen oxides.

32 Claims, 3 Drawing Sheets



US007051765B1

(12) **United States Patent**
Kelley et al.

(10) **Patent No.: US 7,051,765 B1**
(45) **Date of Patent: May 30, 2006**

(54) **BALANCED ORIFICE PLATE**

(75) Inventors: **Anthony R. Kelley**, Madison, AL (US); **Paul D. Van Buskirk**, Humble, TX (US)

(73) Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 192 days.

(21) Appl. No.: **10/750,628**

(22) Filed: **Dec. 19, 2003**

(51) **Int. Cl.**
F15D 1/02 (2006.01)
G01F 1/42 (2006.01)

(52) **U.S. Cl.** **138/44**; 138/40; 73/861.61; 73/861.52

(58) **Field of Classification Search** 138/40, 138/44, 39; 73/861.04, 861.02, 861.61, 861.52
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,687,645 A		8/1954	Velten et al.	138/40 X
3,071,001 A		1/1963	Goldsmith	138/40 X
3,487,688 A		1/1970	Magliozzi	73/861.52
3,521,487 A		7/1970	Akeley	73/861.61
3,545,492 A	*	12/1970	Scheid, Jr.	138/42
3,645,298 A		2/1972	Roberts et al.	138/40
3,750,710 A	*	8/1973	Hayner	138/40
3,779,076 A		12/1973	Akeley	73/861.61
3,805,612 A		4/1974	Shiba	73/861.61
3,838,598 A		10/1974	Tompkins	73/861.52
4,040,293 A		8/1977	Wilson	73/861.61
4,538,470 A		9/1985	Snell	73/861.61
4,557,296 A		12/1985	Byrne	138/44
4,961,344 A		10/1990	Rodder	73/202
5,086,655 A		2/1992	Fredericks et al.	73/861.61
5,295,397 A		3/1994	Hall et al.	73/861.02
5,297,426 A		3/1994	Kane et al.	73/202
5,327,941 A	*	7/1994	Bitsakis et al.	138/42
5,341,848 A		8/1994	Laws	138/44
5,461,932 A		10/1995	Hall et al.	138/40 X
5,529,093 A		6/1996	Gallagher et al.	138/44
6,186,179 B1		2/2001	Hill	138/39
6,345,536 B1		2/2002	Morrison et al.	73/861.04
6,494,105 B1		12/2002	Gallagher	73/861.27

FOREIGN PATENT DOCUMENTS

GB	0522708 A2	6/1992
GB	95/02165	7/1994
JP	58191922	11/1983
JP	63253258	4/1987

* cited by examiner

Primary Examiner—Patrick Brinson
(74) *Attorney, Agent, or Firm*—James J. McGroary; Peter J. Van Bergen

(57) **ABSTRACT**

An orifice plate for use in a conduit through which fluid flows is defined by a central circular region having a radius R_0 and a ring-shaped region surrounding the central circular region. The ring-shaped region has holes formed therethrough with those holes centered at each radius R thereof satisfying a relationship

$$A_R = a/(X_R V_R^b)$$

where

A_R is a sum of areas of those holes having centers at radius R,

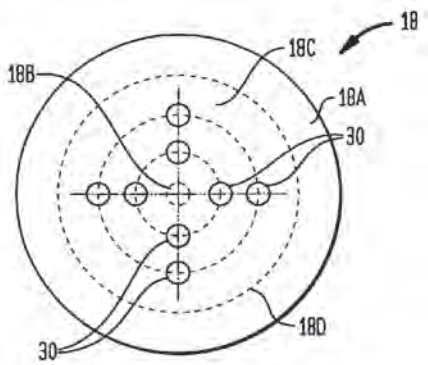
X_R is a flow coefficient at radius R,

V_R is a velocity of the fluid that is to flow through the conduit at radius R,

b is a constant selected to make at least one process variable (associated with the fluid that is to flow through the conduit) approximately equal at each radius R, and

a is a constant that is equal to $(X_R A_R V_R^b)$ at each radius R.

26 Claims, 4 Drawing Sheets



US006974855B1

(12) **United States Patent**
Meador

(10) **Patent No.: US 6,974,855 B1**
(45) **Date of Patent: *Dec. 13, 2005**

(54) **POLYIMIDES BY PHOTOCHEMICAL CYCLOPOLYMERIZATION**

(75) Inventor: **Michael A. Meador**, Strongsville, OH (US)

(73) Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 150 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/617,447**

(22) Filed: **Jul. 8, 2003**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/827,140, filed on Apr. 5, 2001, now Pat. No. 6,593,389.

(51) **Int. Cl.**[7] **C08G 12/00**
(52) **U.S. Cl.** **528/228**; 528/220; 522/167
(58) **Field of Search** 522/178, 167; 528/220, 228; 526/316

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,140,385 A * 10/2000 Bowers et al. 522/37
6,153,662 A * 11/2000 Miller et al. 522/63
6,593,389 B1 * 7/2003 Meador 522/36

OTHER PUBLICATIONS

Macromolecules vol. 29, No. 27, pp. 8983-8986.
NASA News, Sampe Jour. vol. 36, No. 5, Sep. 2000, Jones et al, "Curable Polyimides . . . ".
Lewis Research Ctr, "Room Temperature Ultraviolet Curing of Polyimides", NASA Tech Briefs, Mar. 1999.

* cited by examiner

Primary Examiner—Susan Berman
(74) *Attorney, Agent, or Firm*—Kent N. Stone; James V. Tura

(57) **ABSTRACT**

The novel polyimides of this invention are derived from Diels-Alder cyclopolymerization of photochemically generated bisdienes with dienophiles, such as bismaleimides, trismaleimides and mixtures thereof with maleimide end-caps. Irradiation of one or more diketones produces two distinct hydroxy o-quinodimethane (photoenol) intermediates. These intermediates are trapped via Diels-Alder cycloaddition with appropriate dienophiles, e.g., bismaleimide and/or trismaleimides to give the corresponding polyimides in quantitative yields. When bismaleimides, trismaleimides or mixtures thereof with maleimide end-caps are used as the dienophile, the resulting polyimides have glass transition temperatures (Tg) as high as 300° C. Polyimide films can be prepared by ultraviolet irradiation of high solids content varnishes of the monomers in a small amount of solvent, e.g., cyclohexanone, dimethyl formamide, N-methylpyrollidone and the like. These novel polyimides are characterized as having high glass transition temperatures, good mechanical properties and improved processing in the manufacture of adhesives, electronic materials and films.

20 Claims, No Drawings

US00D526453S

(12) **United States Design Patent** (10) **Patent No.: US D526,453 S**
Jun (45) **Date of Patent: ** Aug. 8, 2006**

(54) **WASHING MACHINE**

(75) Inventor: **Jeong-June Jun**, Seoul (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.**, Kyunnggi-do (KR)

(**) Term: **14 Years**

(21) Appl. No.: **29/251,269**

(22) Filed: **Jan. 5, 2006**

(51) **LOC (8) Cl.** **15-05**
(52) **U.S. Cl.** **D32/6**
(58) **Field of Classification Search** ..... 68/3 R, 68/4, 5 R, 12.01, 12.08, 212; 34/58, 109, 34/130–132, 417, 499, 523, 534, 595–597, 34/600, 603; D32/1, 5, 6, 10, 25, 28, 58; 312/31; 38/1 A
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D292,629 S	*	11/1987	Nagai et al.	D32/6
D360,501 S	*	7/1995	Ertz et al.	D32/6
D446,891 S	*	8/2001	Kim	D32/6
D477,898 S	*	7/2003	Geyer	D32/6
D490,946 S	*	6/2004	Suh et al.	D32/6
D491,324 S	*	6/2004	Kim et al.	D32/6

OTHER PUBLICATIONS

U.S. Appl. No. 29/251,268, Applicant: Jeong-June Jun, filed Jan. 5, 2006 entitled Washing Machine.

* cited by examiner

Primary Examiner—Louis S. Zarfas
Assistant Examiner—Kathleen Sims
(74) *Attorney, Agent, or Firm*—Fynn, Thiel, Boutell & Tanis, P.C.

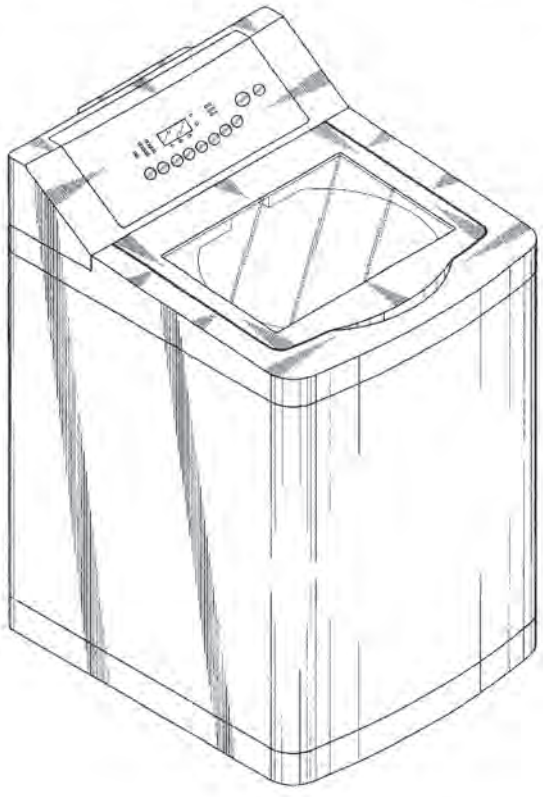
(57) **CLAIM**

The ornamental design for a washing machine, as shown and described.

DESCRIPTION

FIG. **1** is a top front perspective view of a washing machine showing our new design;
FIG. **2** is a front elevational view thereof;
FIG. **3** is a rear elevational view thereof;
FIG. **4** is a left side elevational view, the right side being symmetrical thereof;
FIG. **5** is a top plan view thereof; and,
FIG. **6** is a bottom plan view.

1 Claim, 4 Drawing Sheets



US00PP16970P2

(12) **United States Plant Patent**
de Groot

(10) **Patent No.: US PP16,970 P2**
(45) **Date of Patent: Aug. 8, 2006**

(54) ***ROSA* PLANT NAMED 'RUIZ012A'**

(50) Latin Name: ***Rosa***
Varietal Denomination: **RUIZ012A**

(75) Inventor: **Henk C. A. de Groot**, De Kwakel (NL)

(73) Assignee: **De Ruiter's Nieuwe Rozen B.V.**, De Kwakel (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 400 days.

(21) Appl. No.: **10/894,197**

(22) Filed: **Jul. 19, 2004**

(51) **Int. Cl.**
A01H 5/00 (2006.01)

(52) **U.S. Cl.** **Plt./122**
(58) **Field of Classification Search** Plt./122, Plt./129
See application file for complete search history.

Primary Examiner—Anne Marie Grunberg
Assistant Examiner—June Hwu
(74) *Attorney, Agent, or Firm*—Mark P. Bourgeois

(57) **ABSTRACT**

A new cultivar of *Rosa* plant named 'RUIZ012A' that is characterized by a compact habit, long life and red flowers.

1 Drawing Sheet

Botanical classification: *Rosa*.
Variety denomination: 'RUIZ012A'.

BACKGROUND OF THE INVENTION

The present invention relates to a new and distinct cultivar of Rose plant botanically known as *Rosa* and hereinafter referred to by the cultivar name 'RUIZ012A'.

The new cultivar is the product of a breeding program conducted by the inventor in a cultivated area of Hazerswoude, The Netherlands. The objective of the breeding program was to develop miniature roses with attractive flower and foliage colors. 'RUIZ012A' is a hybrid that originated from the induced hybridization of the female or seed parent *Rosa* 'Ruiscar' (not patented) and the male or pollen parent *Rosa* 'Poulracos' (not patented). The cultivar 'RUIZ012A' was selected by the inventor in May of 2000 as a single plant within the progeny of the stated cross in a controlled environment of Hazerswoude, The Netherlands.

The closest comparison plant is *Rosa* 'Ruiskjol' (U.S. Plant Pat. No. 12,672) 'RUIZ012A' is distinguishable from 'Ruiskjol' by larger lighter color flowers, leaves with a dark green upper side and a grey-green under side and a more compact habit.

The new cultivar 'RUIZ012A' is distinguishable from the female parent *Rosa* 'Ruiscar' in having dark red flowers. The flowers of 'Ruiscar' are pink with a yellow center. The new cultivar 'RUIZ012A' is distinguishable from the male parent *Rosa* 'Poulracos' in having larger flowers.

Asexual reproduction by cuttings of the new cultivar 'RUIZ012A' was first performed in December of 2000 in Hazerwsoude, The Netherlands. Since that time, under careful observation, the unique characteristics of the new Rose cultivar have been uniform, stable and reproduced true to type in successive generations of asexual reproduction.

SUMMARY OF THE INVENTION

The following represent the distinguishing characteristics of the new *Rosa* cultivar 'RUIZ012A'. These traits in combination distinguish 'RUIZ012A' as a new and distinct cultivar apart from all other existing varieties of *Rosa* known to the inventor. 'RUIZ012A' has not been tested under all

possible conditions and phenotypic differences may be observed with variations in environmental, climatic, and cultural conditions, however, without any variance in genotype.

Rosa 'RUIZ012A' exhibits a compact habit.

Rosa 'RUIZ012A' exhibits red flowers.

Rosa 'RUIZ012A' exhibits a long plant life.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing illustrates the distinguishing traits of *Rosa* 'RUIZ012A'. The plant in the drawing is 12 weeks old and was glass greenhouse grown in a 10 cm. container. The drawing shows the overall plant. The photograph was taken using conventional techniques and although colors may appear different from actual colors due to light reflectance it is as accurate as possible by conventional photographic techniques.

BOTANICAL DESCRIPTION OF THE PLANT

The following is a detailed description of the new *Rosa* cultivar named 'RUIZ012A'. Data was collected in Amstelveen, The Netherlands from 12 weeks old glass greenhouse grown plants in a 10 cm. container. The time of year was March and the average temperature was 18° Centigrade during the day and 16° Centigrade at night. The light level was 5000 Lux. No photoperiodic treatments were used. Bonsi growth retardant was applied. Color determinations are in accordance with The Royal Horticultural Society Colour Chart 1995 except where general color terms of ordinary dictionary significance are used. The growing requirements are similar to the species.

Botanical classification: *Rosa* 'RUIZ012A'.
Type: Perennial.
Use: Ornamental.
Parentage: 'RUIZ012A' is a hybrid plant that resulted from the induced hybridization of the following parent plants:
Female parent.—*Rosa* 'Ruiscar' (not patented).
Male parent.—*Rosa* 'Poulracos' (not patented).
Vigor: Moderate.
Growth rate: Approximately 8 cm. per month.

US006802444B1

(12) **United States Patent**
Petter et al.

(10) **Patent No.: US 6,802,444 B1**
(45) **Date of Patent: Oct. 12, 2004**

(54) **HEAT TREATMENT OF FRICTION STIR WELDED 7X50 ALUMINUM**

(75) Inventors: **George E. Petter**, Houston, TX (US); **John D. Figert**, Friendswood, TX (US); **Daniel J. Rybicki**, Houston, TX (US); **Timothy H. Burns**, Sugar Land, TX (US)

(73) Assignee: **The United States of America as represented by the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 71 days.

(21) Appl. No.: **10/390,678**

(22) Filed: **Mar. 17, 2003**

(51) **Int. Cl.**[7] **B23K 20/12**; C22F 1/04

(52) **U.S. Cl.** **228/112.1**; 228/2.1; 228/200; 148/516; 148/690

(58) **Field of Search** 228/112.1, 2.1, 228/200; 148/516, 535, 549, 688, 690

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,881,966	A		5/1975	Staley et al.
3,947,297	A		3/1976	Reimann et al.
4,426,429	A		1/1984	Russo et al.
4,431,467	A		2/1984	Staley et al.
RE34,008	E		7/1992	Quist et al.
5,221,377	A		6/1993	Hunt, Jr. et al.
5,277,719	A		1/1994	Kuhlman et al.
5,810,949	A		9/1998	Chakrabarti et al.
6,168,067	B1		1/2001	Waldron et al.
6,398,883	B1		6/2002	Forrest et al.
6,638,381	B2	*	10/2003	Keener et al. 148/669
6,726,085	B2	*	4/2004	Litwinski et al. 228/112.1
2002/0121319	A1	*	9/2002	Chakrabarti et al. 148/694
2002/0125297	A1	*	9/2002	Stol et al. 228/112.1
2003/0072671	A1	*	4/2003	Kuehmann et al. 420/38
2003/0087122	A1	*	5/2003	Benedictus et al. 428/654
2003/0111147	A1	*	6/2003	Keener et al. 148/671
2003/0116608	A1	*	6/2003	Litwinski 228/112.1
2003/0116609	A1	*	6/2003	Dracup et al. 228/112.1
2003/0218052	A2	*	11/2003	Litwinski 228/112.1
2003/0226625	A1	*	12/2003	Kuehmann et al. 148/621
2003/0226935	A1	*	12/2003	Garratt et al. 244/123
2004/0000576	A1	*	1/2004	Litwinski 228/112.1
2004/0004107	A1	*	1/2004	Litwinski 228/56.3
2004/0050907	A1	*	3/2004	Dracup et al. 228/112.1
2004/0056075	A1	*	3/2004	Gheorghe 228/199

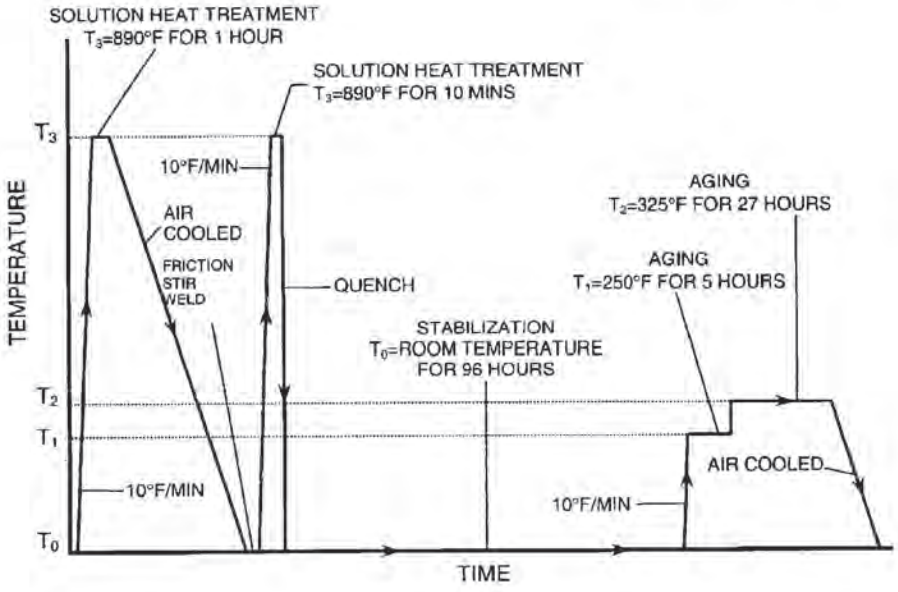
* cited by examiner

Primary Examiner—Kiley Stoner
(74) *Attorney, Agent, or Firm*—Theodore U. Ro

(57) **ABSTRACT**

A method for treating alloy before and after friction stir welding, the method comprising the following steps. First solution heat treating a multiplicity of aluminum-zinc alloy engineered components for a first time period at a first temperature. First air cooling the components in ambient air at room temperature until the components are cooled to room temperature. Friction stir welding the components to form an assembly. Second solution heat treating the assembly for a second time period at a second temperature. Additional steps and embodiments are considered.

28 Claims, 4 Drawing Sheets



4,535,636

The United States of America

The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person or persons having title to this patent the right to exclude others from making, using or selling the invention throughout the United States of America for the term of seventeen years from the date of this patent, subject to the payment of maintenance fees as provided by law.

Acting Commissioner of Patents and Trademarks

Melvenia Gary
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